
Marine Physical Laboratory

Geomorphological and Geomorphometry of the East Pacific Rise Flanks

Peter F. Lonsdale

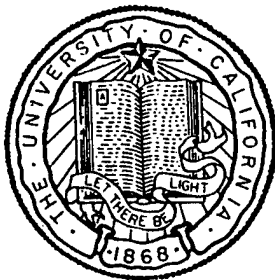
Supported by the
Chief of Naval Research
Grant N00014-93-1-0042

Final Report

19970204 007

**MPL-U-19/96
October 1996**

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Scripps Institution of Oceanography

REPORT DOCUMENTATION PAGE			Form Approved OMB No. 0704-0188	
Public reporting burden for this collection of information is estimated to average 1 hour per response, including the time for reviewing instructions, searching existing data sources, gathering and maintaining the data needed, and completing and reviewing the collection of information. Send comments regarding this burden estimate or any other aspect of this collection of information, including suggestions for reducing this burden, to Washington Headquarters Services, Directorate for Information Operations and Reports, 1215 Jefferson Davis Highway, Suite 1204, Arlington, VA 22202-4302, and to the Office of Management and Budget, Paperwork Reduction Project (0704-0188), Washington, DC 20503.				
1. Agency Use Only (Leave Blank).	2. Report Date. October 1996	3. Report Type and Dates Covered. Final Report		
4. Title and Subtitle. Geomorphological and Geomorphometry of the East Pacific Rise Flanks		5. Funding Numbers. N00014-93-1-0042		
6. Author(s). Peter F. Lonsdale		Project No. Task No.		
7. Performing Monitoring Agency Name(s) and Address(es). University of California, San Diego Marine Physical Laboratory Scripps Institution of Oceanography San Diego, California 92152		8. Performing Organization Report Number. MPL-U-19/96		
9. Sponsoring/Monitoring Agency Name(s) and Address(es). Chief of Naval Research Department of the Navy 800 North Quincy Street Arlington, VA 22217-5660 Code 322GG		10. Sponsoring/Monitoring Agency Report Number.		
11. Supplementary Notes.				
12a. Distribution/Availability Statement. Approved for public release; distribution is unlimited.			12b. Distribution Code.	
13. Abstract (Maximum 200 words). A marine geophysical survey of the seafloor east and west of the rise crest ONR Natural Laboratory was used to interpret the geologic history that has determined the shape, structure, and pattern of the present East Pacific Rise axis, and to study the fates of crust after it leaves the axis. The emphasis of this work was on tectonic processes that modify the structure of young oceanic crust, and on quantifying the effects of these processes on seafloor roughness.				
14. Subject Terms. geophysical survey, tectonic processes, geophysical traverse, geomorphology			15. Number of Pages. 2	
			16. Price Code.	
17. Security Classification of Report. Unclassified	18. Security Classification of This Page. Unclassified	19. Security Classification of Abstract. Unclassified	20. Limitation of Abstract. None	

Geomorphological and Geomorphometry of East Pacific Rise Flanks

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Final Report to the
Office of Naval Research
Grant N00014-93-1-0042
for the Period 10-1-92 - 9-30-95

Abstract

A marine geophysical survey of the seafloor east and west of the rise crest ONR Natural Laboratory was used to interpret the geologic history that has determined the shape, structure, and pattern of the present East Pacific Rise axis, and to study the fates of crust after it leaves the axis. The emphasis of this work was on tectonic processes that modify the structure of young oceanic crust, and on quantifying the effects of these processes on seafloor roughness.

Research Objective

The objectives of this project were (1) to establish the geologic history of a large tract of seafloor containing on ONR Natural Laboratory, and thereby derive better understanding of the typical long-term behavior of a fast-spreading rise crest; and (2) to improve quantitative assessments of seafloor roughness in areas of known and complex geologic history. The first objective has been met more completely than the second.

Research Summary

The primary data used were Seabeam 2000 multibeam bathymetric swaths, magnetic and gravity profiles collected on a 1993 cruise leg to the eastern tropical Pacific. Similar supplementary data was collected in 1995 to fill in what proved to be critical gaps in the principal survey. Coverage of the large study area with new data was by no means complete, so its interpretation required analysis of the large archived volume of preexisting data.

The past 10 m.y. of geologic history proved to include major changes in the rate and direction of spreading, reorientation and abandonment of spreading centers and transform faults, migration of large propagating rifts, and formation and capture of microplates. Only for the past 4 m.y. has this part of the East Pacific Rise had a steady, simple pattern of crustal accretion and deformation. The 10-4Ma geologic history has much in common with the history of the Mathematician microplate region further north, and a comparison of these histories (now being prepared for publication) clarifies which features are merely local idiosyncrasies, which are prevalent patterns of crustal evolution.

Statistical analyses of the multibeam bathymetry have been performed by Dr. Ute Herzfeld (formerly of Scripps Institution of Oceanography) and Dr. Peter Shaw (formerly of Woods Hole Oceanographic Institution). These analyses were able to identify patches of different topographic roughness and lineation direction, patches that could be explained by the conventional geophysical interpretation. They did not, however, materially enhance that interpretation.

Publications

- 1) P. Lonsdale (1995). Segmentation and disruption of the East Pacific Rise in the mouth of the Gulf of California. *Marine Geophysical Researches*, v.17, 323-359.
- 2) E. Baker and P. Lonsdale (1993). Rifting of oceanic lithosphere during growth of the South Mathematician microplate, "EOS, Trans. Am. Geophys. Union, Supplement, p. 605
- 3) K. Williams and P. Lonsdale (1993). Two types of fossil spreading center on Mathematician Ridge. EOS, Trans. Am. Geophys. Union Supplement, p. 605

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